

Li et al.

S/N: 09/683,781

REMARKS

Before responding substantively to the Examiner's rejections, Applicant wishes to clarify a procedural issue in this application. In the Office Action mailed March 26, 2004, the Examiner notes that the Office Action is being provided in response to a communication filed by the Applicant on February 26, 2004. Applicant, however, did not "file" a communication on that date. Applicant provided a courtesy copy to the Examiner on February 26, 2004 of the RCE and Amendment filed on November 14, 2003. Accordingly, as a matter of record, Applicant timely filed, on November 14, 2003, a response to the Office Action of September 10, 2003. As such, Applicant requests reimbursement to Deposit Account 07-0845 for any extension fees or surcharges that were charged to that account as a result of the Office's entering of the RCE and Amendment filing on March 26, 2004.

Claims 1-2, 5-9, 11-17, and 19-26 are pending in the present application. In the Office Action mailed March 26, 2004, claims 1-2, 4-7, 9, 11-17, and 18-26 stand rejected under 35 U.S.C. §102(e) as being anticipated by Ozaki et al. Claim 8 was rejected under 35 U.S.C. §103(a) as being unpatentable over Ozaki et al. in view of Hampel et al. (USP 6,298,117).

Regarding the rejection of claims 1-2, 4-7, 9, 11-17, and 18-26, Ozaki et al. teaches an x-ray computed tomography apparatus that includes "a means for stopping irradiation of [the] x-rays on the subject in a specific period in a cardiac cycle of the subject, and applying the x-rays onto [a] subject in a period other than the specific period on the basis of [an] electrocardiogram." Abstract. More particularly, Ozaki et al. teaches three exemplary x-ray modulation techniques that include switching an x-ray source between OFF and ON states (Fig. 3), Intermittently reducing the amount of voltage applied to an x-ray source (Fig. 11), and controlling x-ray projection through a high speed shutter (Fig. 13). As shown in Figs. 3, 11, and 13, Ozaki et al. teaches a system wherein the systole and diastole are either not imaged or minimally imaged whereas the equivalent diastole through the next systole of a next R-R interval is fully imaged. That is, Ozaki et al. teaches a period of reduced x-ray exposure to a subject either through tube current control or high speed shutter control for a period after the first R pulse of an R-R interval followed by a period whereupon the x-ray exposure to the subject is elevated to a relatively maximum level and is maintained at that maximum level until after the second R pulse of the R-R interval.

For instance, in the embodiment illustrated in Fig. 3, Ozaki et al. teaches an x-ray stop period that covers the systole and diastole phases that occur after the first R pulse of an R-R

Li et al.

S/N: 09/683,781

Interval. In this embodiment, during the x-ray stop period, a voltage is not applied from a high voltage generator to an x-ray tube resulting in no generation of x-rays by the x-ray tube. Col. 3, ll. 55-58. Ozaki et al. further refers to this x-ray stop period as a "specific period" and teaches that with the embodiment illustrated in Fig. 3, "x-rays are stopped in the specific period but generated in the period other than the specific period." Col. 3, ll. 66-67 – Col. 4, l. 1. Ozaki et al. further teaches that "no projection data is detected in the specific period, but projection data is detected in the period other than the specific period." Col. 4, ll. 1-3. This non-specific period is generally referenced as the x-ray generation period in Fig. 3. As shown, the x-ray generation period covers the equivalent diastole phases as well as the time up to the next systole phase of the next R-R interval. In this regard, the high voltage generator applies a voltage sufficient for imaging data acquisition to the x-ray tube to cause projection of x-rays toward the subject for a period that partially includes successive R-R intervals. As shown in Figs 11 and 13, in the two additional embodiments taught by Ozaki et al., data acquisition also continues uninterrupted from a first R-R interval to a next R-R interval. That is, image data acquisition continues uninterrupted before the second R pulse of an R-R interval and continues after the second R pulse which also defines the beginning of the next R-R interval.

In contrast, that called for in the pending claims, as amended, is markedly different and patentably distinguishable from that taught by Ozaki et al. For instance, in claim 1, Applicant has amended the method to call for a data acquisition voltage being applied after the period of delay followed by the acquisition of imaging data whereupon the high frequency electromagnetic energy source is energized to a non-data acquisition voltage until the period of delay after a next triggering pulse. In contrast, as shown in Figs. 3 and 11, Ozaki et al. teaches a period of non-data acquisition after a triggering pulse followed by a period of data acquisition (Fig. 3) or a continuous acquisition of data (Fig. 11). In Fig. 13, Ozaki et al. teaches a constant level of x-ray projection and, as such, the x-ray source is powered at a constant level throughout the cardiac cycle.

Applicant has also amended claim 7 to further define that the control is configured to determine a primary data acquisition stage and a secondary data acquisition stage for an R-R interval. Claim 7 has been further amended to define that the primary data acquisition stage begins after the triggering pulse and that the secondary data acquisition stage occurs after the primary acquisition stage and ends before the next triggering pulse that defines the beginning of the next R-R interval. As described above, Ozaki et al. clearly teaches the overlapping of data

Li et al.

S/N: 09/683,781

acquisition between successive R-R intervals. This is clearly shown in each of Figs. 3, 11, and 13 wherein the x-ray generation period, high x-ray control signal, and open high speed shutter, respectively, define a period that extends from the equivalent diastole of an R-R interval to beginning of the systole phase of the next R-R interval. It is thus clear that which is called for in claim 7 is patentably distinct from Ozaki et al.

Claim 15 has been amended to further define that each secondary acquisition stage follows a primary data acquisition stage and where each primary data acquisition stage occurs entirely within a respective R-R interval. Claim 15 has been further amended to define the secondary acquisition stage as being the result of application of a voltage less than the voltage applied to the x-ray projection source during the primary acquisition stage. As described above, Ozaki et al. teaches that its primary data acquisition stage, in the case of the embodiment of Fig. 1, or the only data acquisition stage in the embodiments of Figs. 3 and 13, does not occur entirely within a single R-R interval. Simply, the primary data acquisition stages taught by Ozaki et al. overlap between successive R-R intervals. As such, Applicant believes that which is called for in claim 15 to be patentably distinct from that which is taught by Ozaki et al.

Claim 22 has also been amended to define that each primary acquisition period begins after a first R pulse of a cardiac cycle and that the secondary acquisition period occurs after the primary acquisition period and begins before the second R pulse of the cardiac cycle. Moreover, claim 22 has been amended to define that the primary voltage exceeds the default non-zero voltage as applied to the x-ray source during CT data acquisition for the secondary acquisition. As discussed in great detail above, Ozaki et al. fails to teach or suggest such a method of cardiac CT imaging. Therefore, Applicant respectfully believes that the amendments made to claim 22 further define that which is claimed over the art of record.

With respect to claim 24, Applicant has amended the claim to further define that the control is configured to apply a first voltage to a high frequency electromagnetic energy projection source between the first and second R pulses of a cardiac cycle. The control is further configured to apply, after the acquisition of imaging data with the high frequency electromagnetic energy projection source being energized at the first voltage, a second voltage to the high frequency electromagnetic energy source before the second R pulse of a current cardiac cycle. Claim 24 has also been amended to define that the first voltage exceeds the second voltage. As set forth above, Ozaki et al. fails to teach or suggest such a radiation

Li et al.

S/N: 09/683,781

emitting imaging system. Therefore, Applicant respectfully believes that which is called for in claim 24 to be patentably distinct from the art of record.

With respect to the rejection of claim 8 under 35 U.S.C. §103(a), Applicant respectfully disagrees with the Examiner with respect to the art as applied, but in light of claim 8 depending from what is believed an otherwise allowable claim, Applicant does not believe that additional remarks are necessary and therefore requests allowance based on the chain of dependency.

Therefore, in light of at least the foregoing, Applicant respectfully believes that the present application is in condition for allowance. As a result, Applicant respectfully requests timely issuance of a Notice of Allowance for claims 1-2, 4-8, 12-16, and 19-26.

Applicant appreciates the Examiner's consideration of these Amendments and Remarks and cordially invites the Examiner to call the undersigned, should the Examiner consider any matters unresolved.

Respectfully submitted,



J. Mark Wilkinson
Registration No. 48,865
Direct Dial 262.376.5016
jmw@zpspatents.com

Dated: April 26, 2004
Attorney Docket No.: GEMS8081.117

P.O. ADDRESS:
Ziolkowski Patent Solutions Group, LLC
14135 North Cedarburg Road
Mequon, WI 53097-1416
262-376-5170